FIG. 1

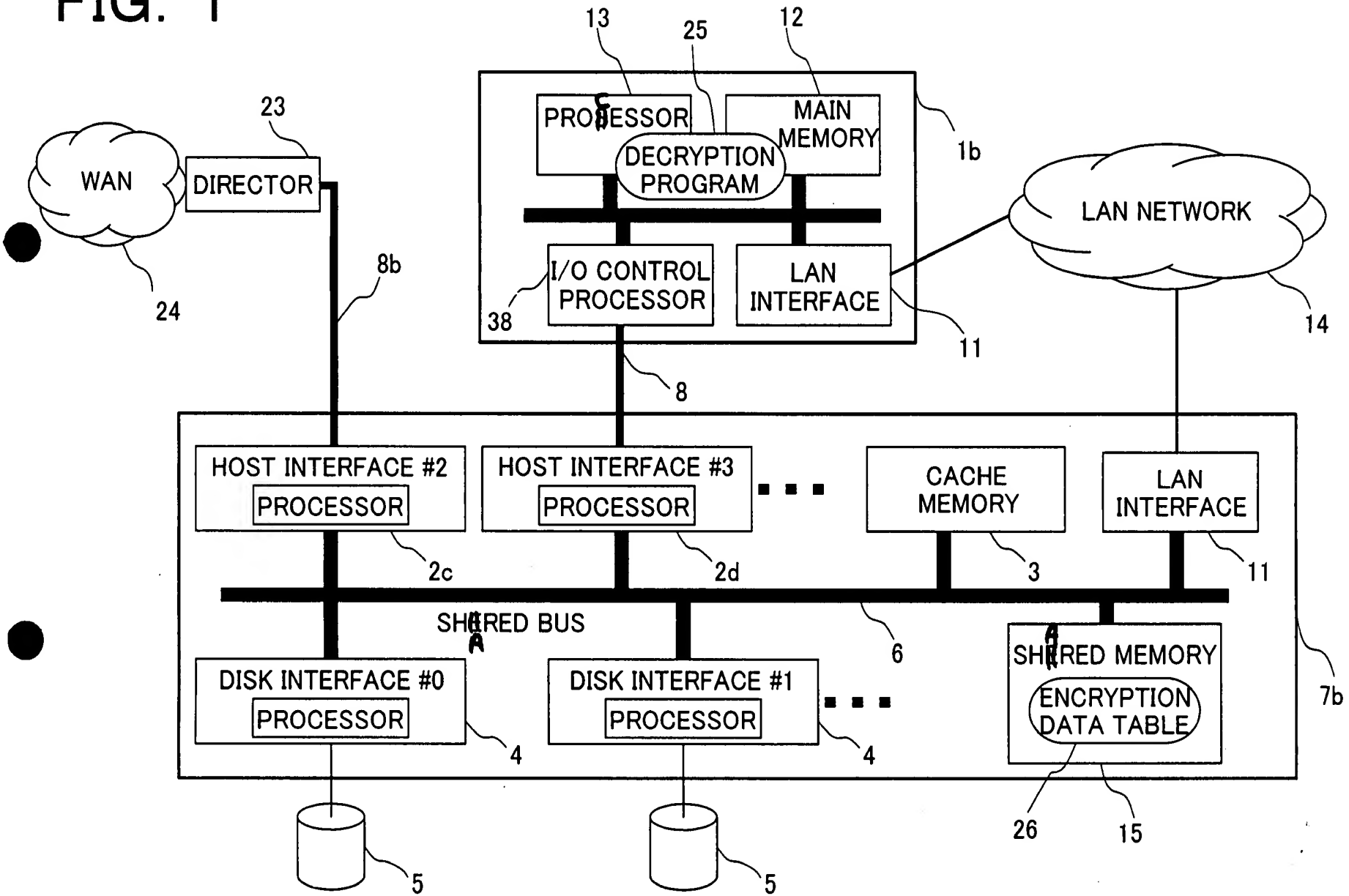

13
25
12
PROCESSOR
MAIN MEMORY
DECRYPTION PROGRAM
1b
23
WAN
DIRECTOR
LAN NETWORK
24
8b
38
I/O CONTROL PROCESSOR
LAN INTERFACE
11
14
8
HOST INTERFACE #2
PROCESSOR
HOST INTERFACE #3
PROCESSOR
CACHE MEMORY
LAN INTERFACE
2c
2d
3
11
SHARED BUS
6
SHARED MEMORY
ENCRYPTION DATA TABLE
7b
DISK INTERFACE #0
PROCESSOR
DISK INTERFACE #1
PROCESSOR
4
4
26
15
5
5

FIG. 2

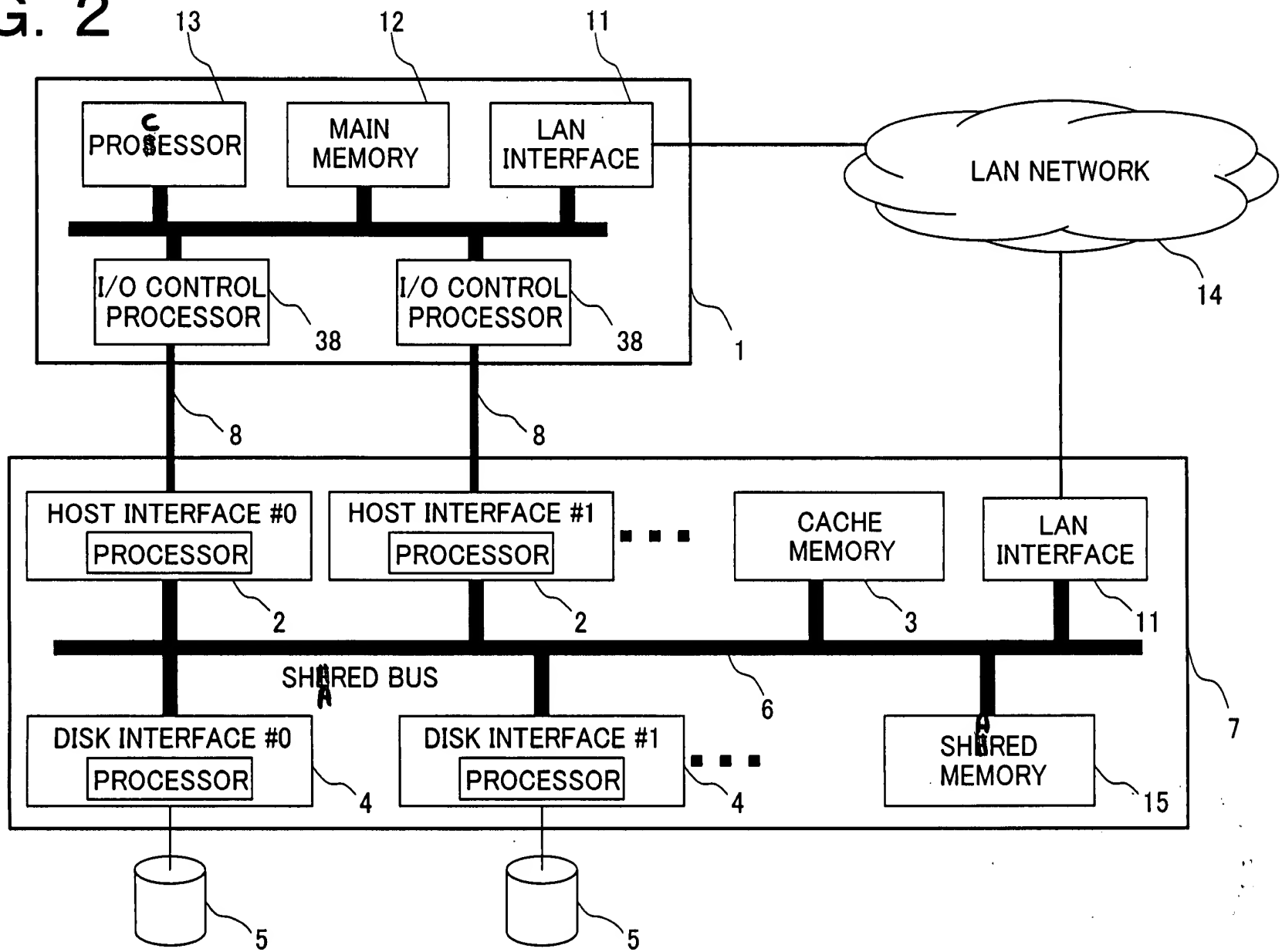

13
12
11
PROCESSOR
MAIN MEMORY
LAN INTERFACE
LAN NETWORK
14
I/O CONTROL PROCESSOR
38
I/O CONTROL PROCESSOR
38
1
8
8
HOST INTERFACE #0
PROCESSOR
HOST INTERFACE #1
PROCESSOR
CACHE MEMORY
LAN INTERFACE
2
2
3
11
SHARED BUS
6
7
DISK INTERFACE #0
PROCESSOR
DISK INTERFACE #1
PROCESSOR
SHARED MEMORY
4
4
15
5
5

FIG. 5

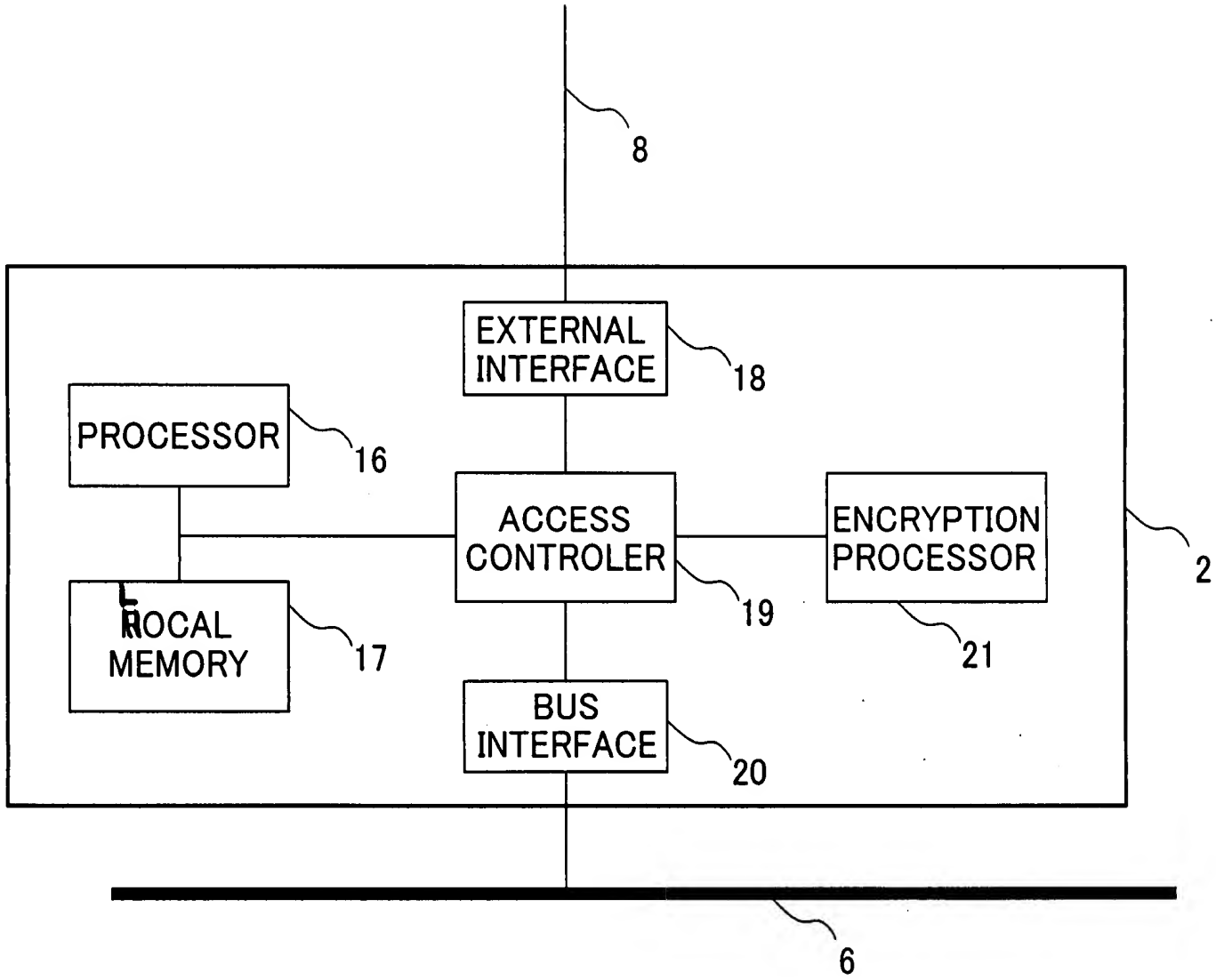

8
EXTERNAL INTERFACE
18
PROCESSOR
16
ACCESS CONTROLER
19
ENCRYPTION PROCESSOR
21
2
LOCAL MEMORY
17
BUS INTERFACE
20
6

FIG. 14

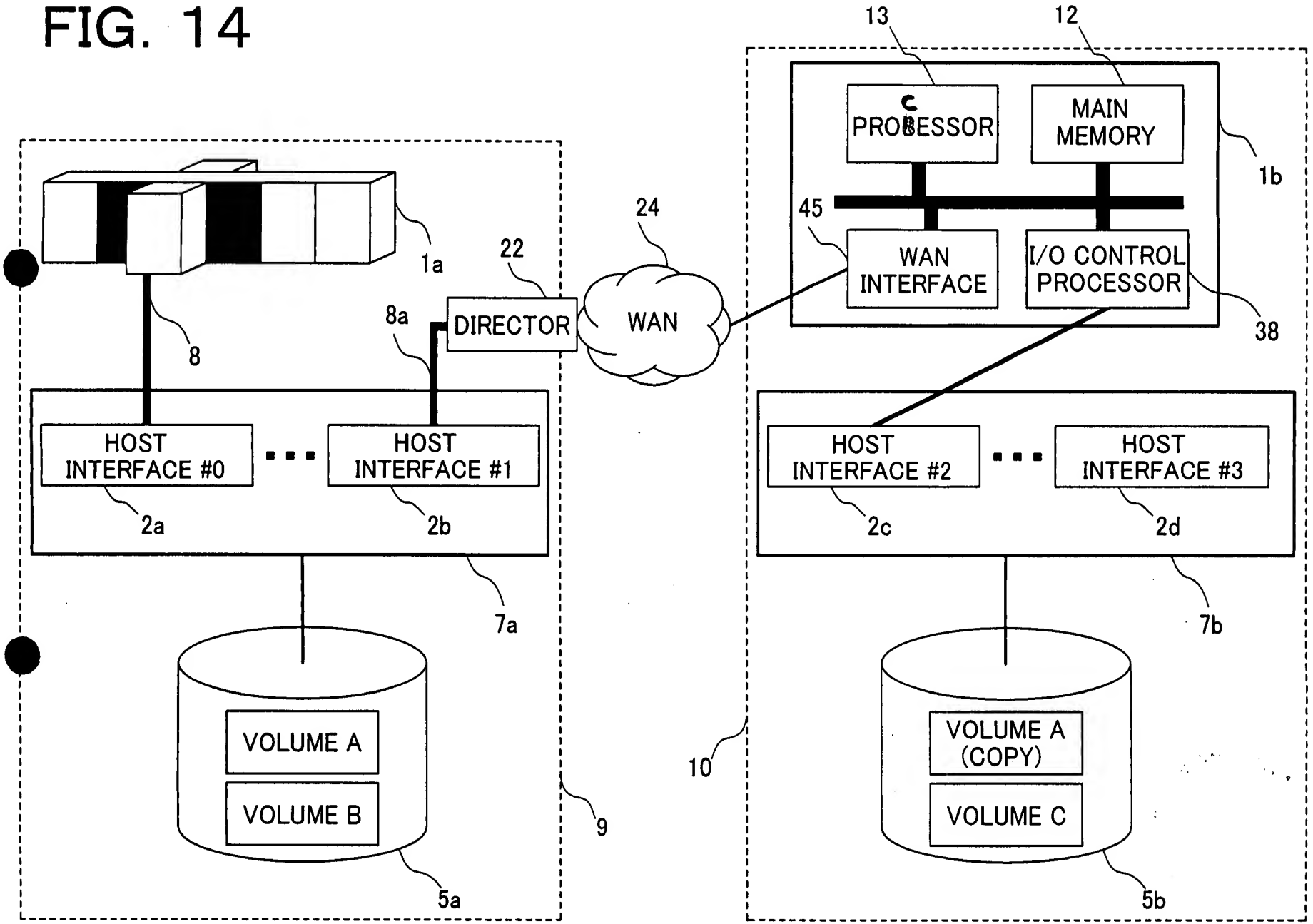

13
12
PROCESSOR
MAIN MEMORY
1b
45
WAN INTERFACE
I/O CONTROL PROCESSOR
38
24
22
WAN
DIRECTOR
8a
8
1a
HOST INTERFACE #0
HOST INTERFACE #1
2a
2b
7a
VOLUME A
VOLUME B
5a
9
HOST INTERFACE #2
HOST INTERFACE #3
2c
2d
7b
VOLUME A (COPY)
VOLUME C
5b
10

FIG. 16

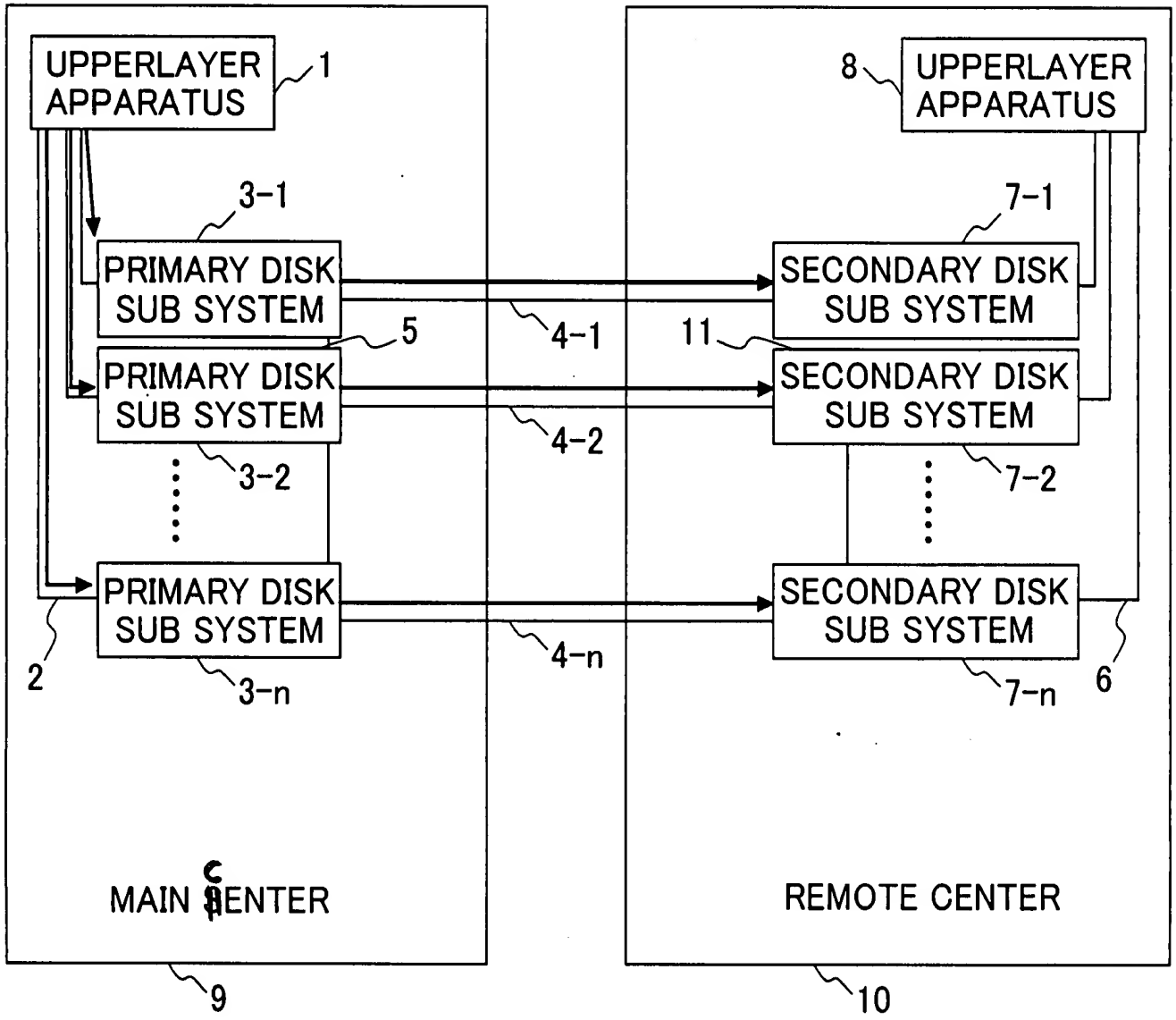

UPPERLAYER APPARATUS
1
8
UPPERLAYER APPARATUS
3-1
7-1
PRIMARY DISK SUB SYSTEM
SECONDARY DISK SUB SYSTEM
5
4-1
11
PRIMARY DISK SUB SYSTEM
SECONDARY DISK SUB SYSTEM
4-2
3-2
7-2
PRIMARY DISK SUB SYSTEM
SECONDARY DISK SUB SYSTEM
2
4-n
6
3-n
7-n
MAIN CENTER
REMOTE CENTER
9
10

FIG. 17

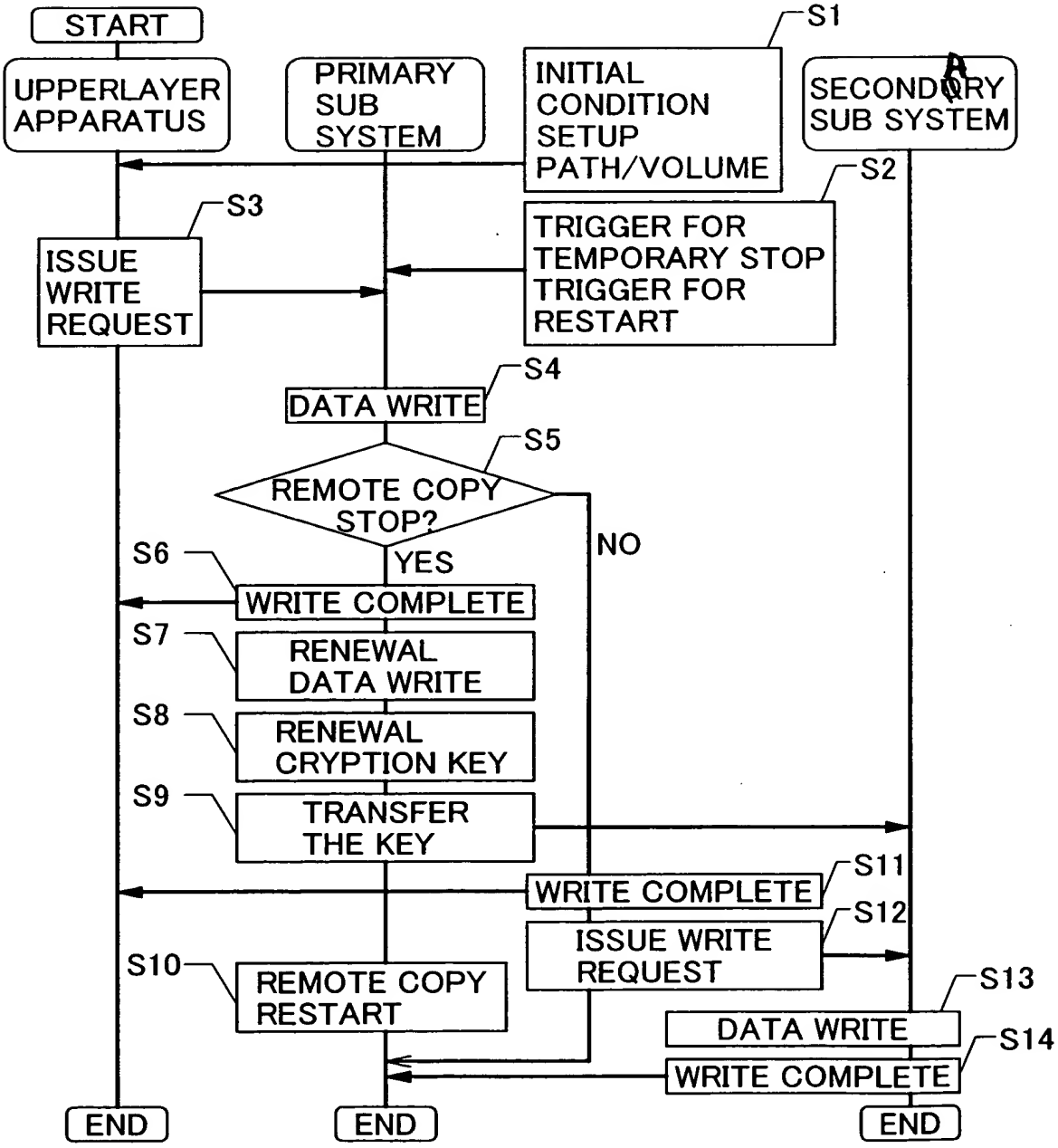

START
UPPERLAYER APPARATUS
PRIMARY SUB SYSTEM
INITIAL CONDITION SETUP PATH/VOLUME
S1
SECONDARY SUB SYSTEM
S2
TRIGGER FOR TEMPORARY STOP TRIGGER FOR RESTART
S3
ISSUE WRITE REQUEST
S4
DATA WRITE
S5
REMOTE COPY STOP?
YES
NO
S6
WRITE COMPLETE
S7
RENEWAL DATA WRITE
S8
RENEWAL CRYPTION KEY
S9
TRANSFER THE KEY
S11
WRITE COMPLETE
S12
ISSUE WRITE REQUEST
S10
REMOTE COPY RESTART
S13
DATA WRITE
S14
WRITE COMPLETE
END
END
END

FIG. 18

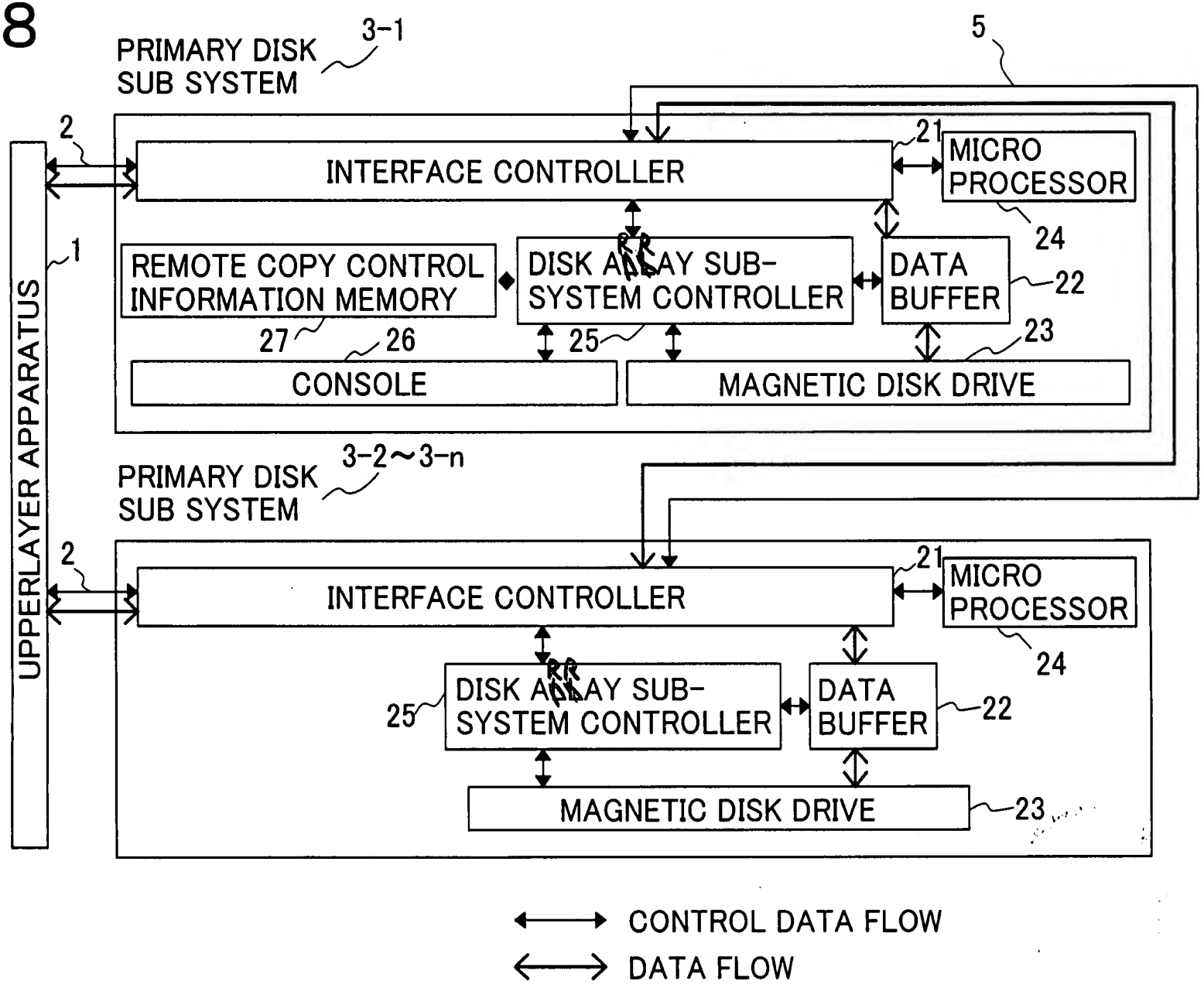

PRIMARY DISK SUB SYSTEM
3-1
5
2
21
INTERFACE CONTROLLER
MICRO PROCESSOR
24
UPPERLAYER APPARATUS
1
REMOTE COPY CONTROL INFORMATION MEMORY
DISK ARRAY SUB-SYSTEM CONTROLLER
DATA BUFFER
22
27
26
25
23
CONSOLE
MAGNETIC DISK DRIVE
PRIMARY DISK SUB SYSTEM
3-2～3-n
2
21
INTERFACE CONTROLLER
MICRO PROCESSOR
24
25
DISK ARRAY SUB-SYSTEM CONTROLLER
DATA BUFFER
22
MAGNETIC DISK DRIVE
23
CONTROL DATA FLOW
DATA FLOW

FIG. 19

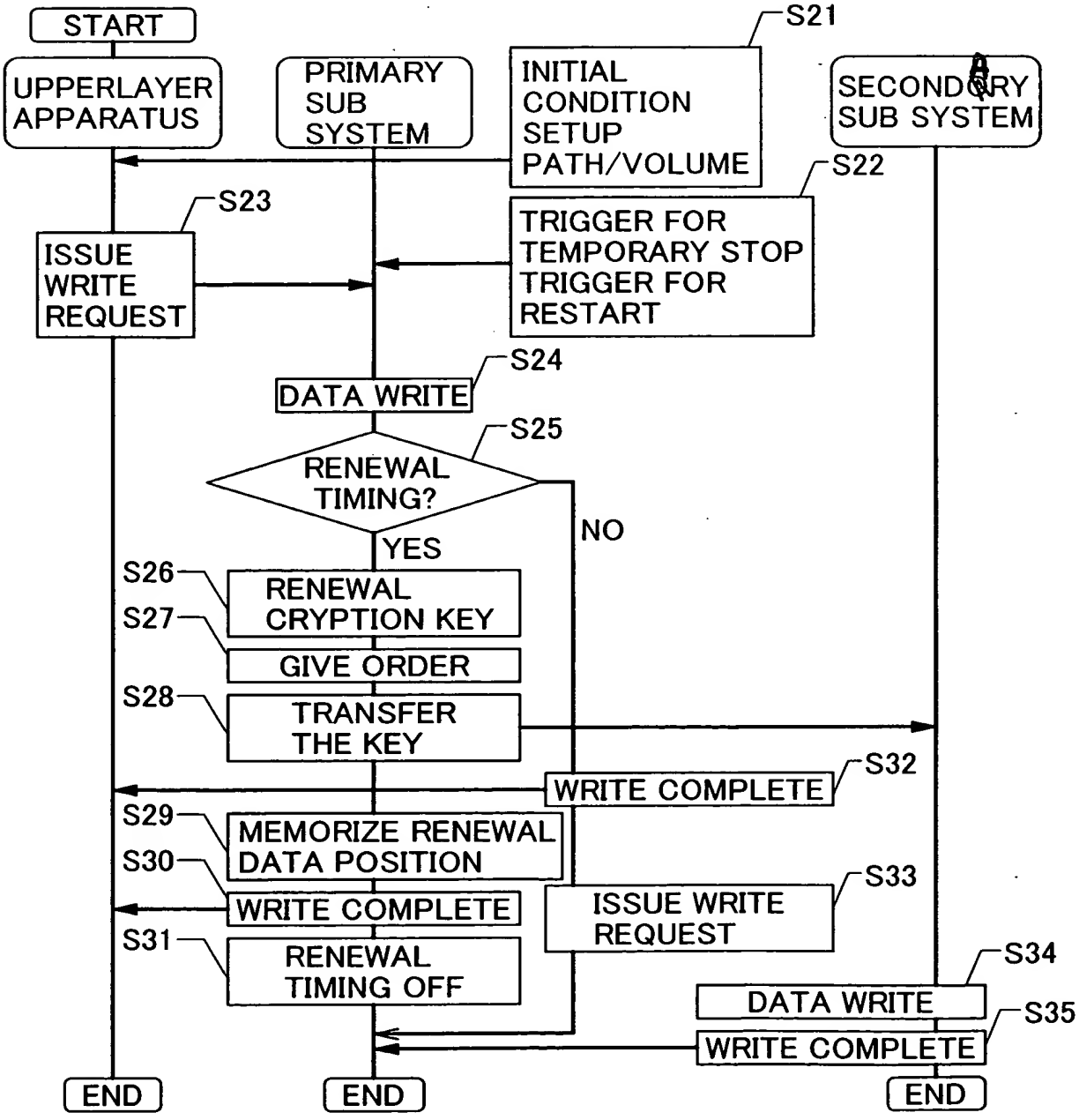

START
UPPERLAYER APPARATUS
PRIMARY SUB SYSTEM
S21
INITIAL CONDITION SETUP PATH/VOLUME
SECONDARY SUB SYSTEM
S22
TRIGGER FOR TEMPORARY STOP TRIGGER FOR RESTART
S23
ISSUE WRITE REQUEST
S24
DATA WRITE
S25
RENEWAL TIMING?
NO
YES
S26
RENEWAL CRYPTION KEY
S27
GIVE ORDER
S28
TRANSFER THE KEY
S32
WRITE COMPLETE
S29
MEMORIZE RENEWAL DATA POSITION
S30
WRITE COMPLETE
S33
ISSUE WRITE REQUEST
S31
RENEWAL TIMING OFF
S34
DATA WRITE
S35
WRITE COMPLETE
END
END
END

FIG. 20

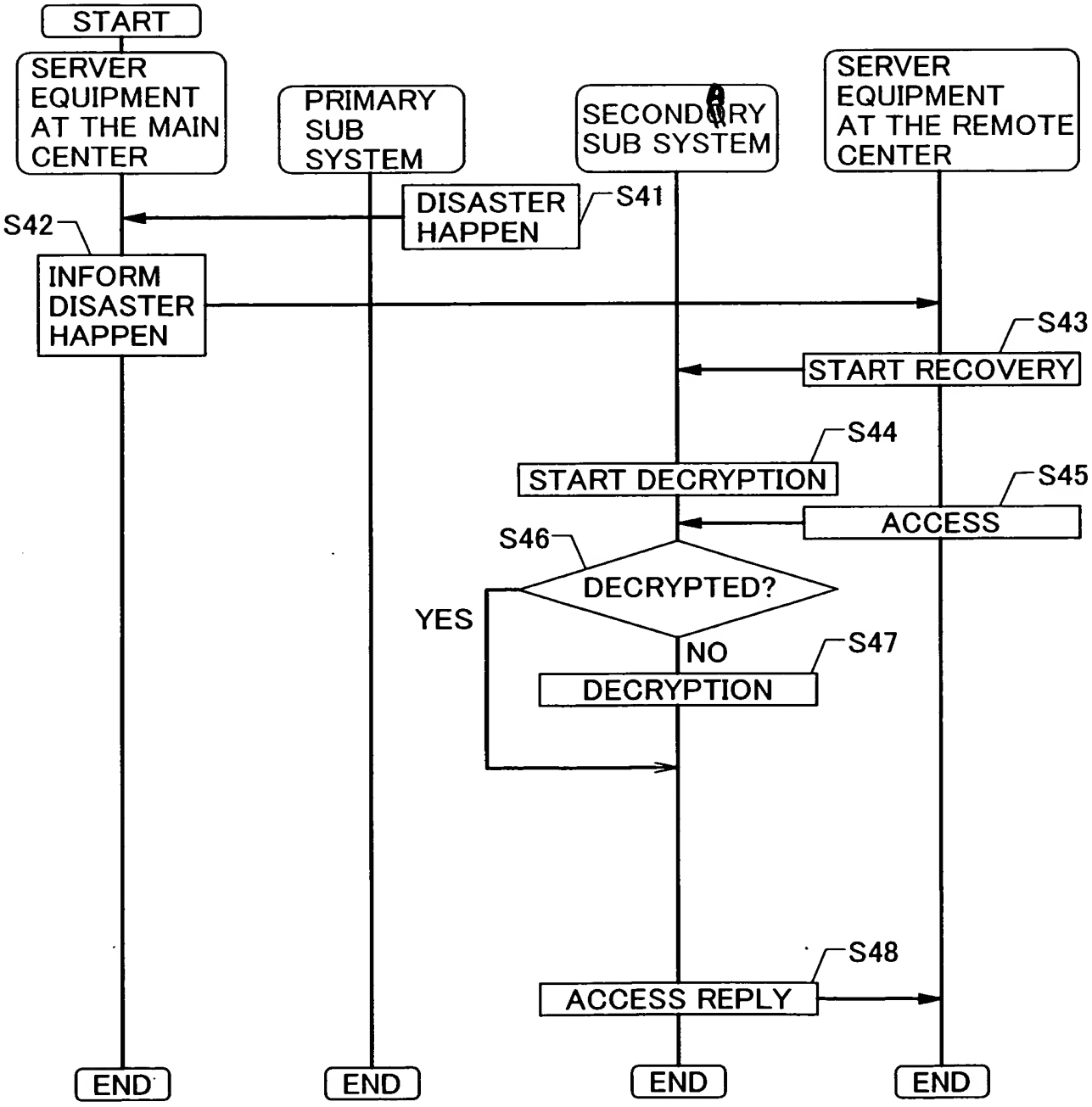
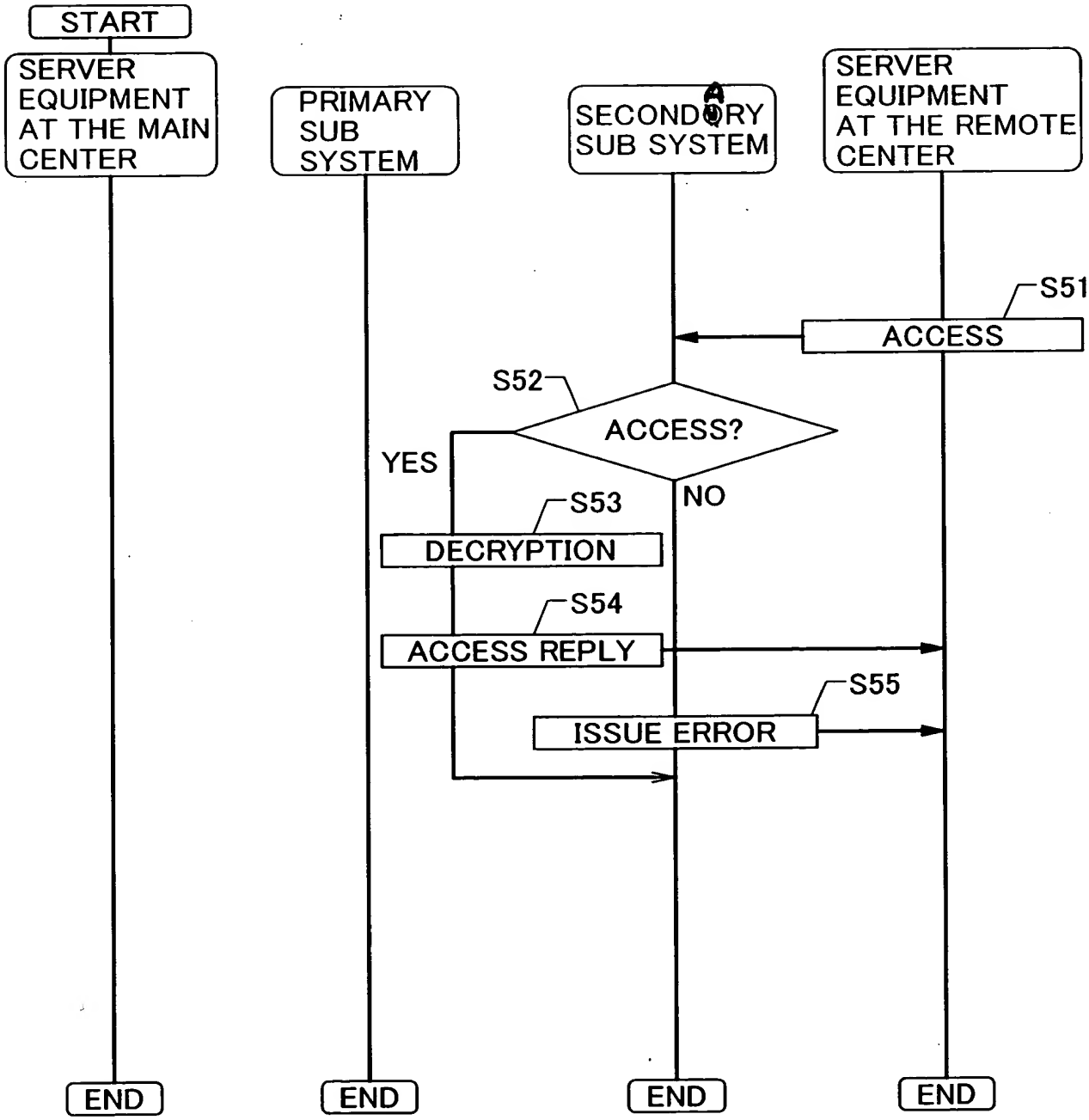

START
SERVER EQUIPMENT AT THE MAIN CENTER
PRIMARY SUB SYSTEM
SECONDARY SUB SYSTEM
SERVER EQUIPMENT AT THE REMOTE CENTER
DISASTER HAPPEN
S41
S42
INFORM DISASTER HAPPEN
S43
START RECOVERY
S44
START DECRYPTION
S45
ACCESS
S46
DECRYPTED?
YES
NO
S47
DECRYPTION
S48
ACCESS REPLY
END
END
END
END

FIG. 21


START
SERVER EQUIPMENT AT THE MAIN CENTER
PRIMARY SUB SYSTEM
SECONDARY SUB SYSTEM
SERVER EQUIPMENT AT THE REMOTE CENTER
S51
ACCESS
S52
ACCESS?
YES
NO
S53
DECRYPTION
S54
ACCESS REPLY
S55
ISSUE ERROR
END
END
END
END